Committee on Tidal Hydraulics

Minutes of the 105th Meeting

26-28 March 1996

Executive Summary

The U.S. Army Corps of Engineers Committee on Tidal Hydraulics (CTH) met in New Orleans, LA on 26-28 March 1996 at the request of the New Orleans District.

The New Orleans District briefed the CTH on four major projects. Three briefings were new to the CTH and one was an update of a project presented to the CTH at the 104th meeting in San Francisco, CA. The Mississippi River project Phase III, involves the deepening to 55 feet of the Mississippi River Ship Channel from the Gulf of Mexico to Baton Rouge, LA. The District presented information on the existing project, dredging requirements, and the challenges of maintaining the navigation channel. Numerical model studies evaluating channel maintenance requirements as the result of different

scenarios of channel design and the Mississippi River Ship Channel Improvements study to determine the feasibility of means to significantly reduce the O&M costs of the navigation channel were also discussed. Questions presented to the CTH involved modeling efforts and alternatives, effectiveness of advanced maintenance and sediment traps, salinity intrusion in drought years and dredging alternatives at the Head of Passes.

The Atchafalaya Basin, particularly in the Lower Atchafalaya River, study involves the reevaluation of the project to investigate potential changes to the existing project that could result in improvements of flood protection, navigation, and environmental management techniques. The status of the existing project plus proposals for modeling studies and methods for moving sediment through the system were presented. Questions presented to the CTH related to modeling the effects on water and sediment movement of a proposed jetty at Point Cheveuil and a "sediment ramp" in the Wax Lake Channel.

Coastal Wetlands Protection, Preservation, and Restoration Act (CWPPRA) has a goal of no net loss of coastal wetlands due to developmental activities. The information presented to the CTH centered on two themes, the uses and benefits of barrier islands and possible techniques of sediment diversion to create or maintain wetlands. Questions presented to the CTH involved the potential effects of these restoration efforts on tidal prism and range and the chances for success of some sediment diversion schemes.

The CTH also heard a presentation of results of the modeling efforts relating to the Bonnet Carré Freshwater Diversion project discussed at the 104th meeting in 1995. The model has been validated to existing conditions and various scenarios of Bonnet Carré diversion flows have been run. The model shows tidal phase differences within the MRGO and salt influx into Lake Borgne. Additional model runs are ongoing.

In Executive Session the CTH considered the questions presented by the District and formed four subcommittees to prepare and draft responses. Items of other business considered included the draft recommendations for future CTH activities and consideration for additional members and consultants.

Minutes of the 105th Meeting

26-28 March 1996

---

1. The 105th meeting of the Committee on Tidal Hydraulics (CTH) was held 26-28 March 1996 in New Orleans, LA at the invitation of COL Kenneth Clow, District Engineer, U.S. Army Engineer District, New Orleans.

2. On 26-27 March, the CTH held Technical Sessions on several aspects of the current and future New Orleans Coastal Louisiana projects involving navigation, water quality, and wetlands preservation and restoration. The CTH met in Executive Session during the afternoon of 27 March and the morning of 28 March. All sessions were held at the New Orleans District Office.

3. Attendees were:

Committee on Tidal Hydraulics

William H. McAnally, Jr., Chairman	Waterways Experiment Station
Virginia R. Pankow, Executive Secretary	Water Resources Support Center
Lincoln C. Blake	Charleston District

A. Jay Combe	New Orleans District
Jaime R. Merino	South Pacific Division
Michael R. Palermo	Waterways Experiment Station
A. David Schuldt	Seattle District
Ronald G. Vann	Norfolk District
Samuel B. Powell, Liaison	Headquarters, U.S. Army Corps of Engineers

Consultants

Ray B. Krone	Professor Emeritus, University of California at Davis
Donald W. Pritchard	Professor Emeritus, State University of New York at Stony Brook

Other Corps of Engineers Representatives[1]

COL Kenneth Clow	New Orleans District
Tim Axtman	New Orleans District
Charlie Berger	Waterways Experiment Station
Troy Constance	New Orleans District
Jack Fredine	New Orleans District
Sue Hawes	New Orleans District
Janis Hote	New Orleans District
Arthur Laurent	New Orleans District
Joaquin Mujica	New Orleans District
Al Naomi	New Orleans District
Tom Podany	New Orleans District
Hasan Pourtaheri	New Orleans District
Donna Richey	Waterways Experiment Station
Fred Schilling	New Orleans District
R. H. Schroeder, Jr.	New Orleans District
Jim St. Germain	New Orleans District
D. Vann Stutts	New Orleans District
Les Waquespack	New Orleans District
Kevin Wagner	New Orleans District

Guests[2]

Len Bahr	Louisiana Governor's Office
James R. Buchtel	Louisiana Dept of Natural Resources

[1] Attended Technical Sessions only
[2] Attended Technical Sessions only.

Carrol Clark	Louisiana Dept of Natural Resources
Mark Davis	Coalition to Restore Coastal Louisiana
Karl DeRonen	Louisiana Dept of Natural Resources
Steve Gilbreath	T. Baker Smith & Son
Paul Kemp	Louisiana State University
Mervin Morehiser	Louisiana Dept of Transportation
Jeanine Peeklun	U.S. Environmental Protection Agency
Carl Robichaux	Louisiana Dept of Natural Resources
Angela D. Sago	Louisiana Dept of Transportation
Stephen C. Smith	T. Baker Smith & Son
Joe Suyhada	Louisiana State University

4. The minutes are divided into discussions of presentations made at the Technical Sessions and actions taken at the Executive Session. The order of the minutes is not necessarily the chronological order in which these matters were considered at the meeting.

Technical Sessions

5. COL Kenneth Clow, New Orleans District Engineer, welcomed the CTH members and guests. He presented a brief history of the importance of water to New Orleans and South Louisiana. New Orleans District is responsible for South Louisiana which includes the rivers and drainage basins of the Mississippi and Atchafalaya Rivers as well as the Gulf Intracoastal Waterway (GIWW) and the Mississippi River Gulf Outlet (MRGO). The Mississippi River is vital to New Orleans, the state of Louisiana, and the nation in terms of navigation, commerce, and flood control. Louisiana was formed by river sedimentation and with the construction of the levee system, natural flooding and sedimentation in the marshes has been largely prevented. There has been a loss of 25-35 square miles of coastal marsh annually. Such a loss is of national significance when the productivity of the intricate coastal marsh/water system is considered. Such a complex, interwoven system is difficult to manage. He highlighted the Barrier Island Study as an interagency effort to restore coastal Louisiana and endorsed the prospect of having an outside group take a fresh look at the study including the works in progress and planned for the future.

6. Mr. William H. McAnally, Jr., Chairman of the CTH and Chief of the Waterways & Estuaries Division, Hydraulics Laboratory, Waterways Experiment Station (WES), thanked COL Clow for the welcome and the opportunity for the CTH to be of service to the New Orleans District. He noted that the last CTH meeting held in New Orleans was in 1988. The session continued with the introduction of the committee members and guests.

Mississippi River Project - Mississippi River Ship Channel

7. Mr. Al Naomi, LMN, opened the discussion with some background information and a presentation

on Phase I and II of this project. The Mississippi River Ship Channel, authorized in 1985 for a depth of 55 feet, has been constructed to the 45 foot depth. There is concern regarding the environmental effects of the final deepening to the authorized 55 foot depth. The Mississippi River is central to all activity in South Louisiana. New Orleans depends on the river for water supply, transportation and abundant natural resources.

8. South Louisiana was formed by delta growth as the Mississippi River meandered and deposited the sediment load it carried. The Old River Control Structure is a Corps project designed to keep the major flow in the Mississippi River and prevent it from changing course and flowing to the Gulf via the Atchafalaya River. The control structure maintains a flow of 30% to the Atchafalaya and 70% to the Mississippi. This insures the viability of New Orleans as a major thriving river city. However, land loss through time as a result of subsidence, sea level rise and loss of sediment (due to river control and levees) is having a significant impact on the stability and health of coastal Louisiana.

9. The banks of Southwest Pass have been reconstructed and lined with rock to prevent flow loss over or through the banks. Jetties constrict river flows enabling some scouring which somewhat reduces dredging requirements. By maintaining Southwest Pass, the inland navigation system is able to keep transportation costs low. This is good for navigation but limits sediment flow into the marshes. Attempts to prevent or limit marsh loss include some controlled fresh water river flows and the placement of dredged material into marsh areas.

10. Phase I of the Mississippi River project, completed in 1988, was the deepening of the navigation channel from 40 feet to 45 feet from the mouth to river mile 181. The project included mitigation for salt water intrusion that might effect drinking water sources. In addition to the construction and continual upgrading of water treatment plants and water distribution systems, an underwater weir (sill) can be constructed in the river to slow or prevent salt water from progressing upstream to normally fresh water communities in times of low river flow (200,000 cfs or less). When necessary fresh water is barged to affected communities. With these scenarios the cost for mitigation is greater than the cost for navigation.

11. Phase II, completed in 1994, involved dredging the channel to 45 feet from river mile 181 to mile 232.4. Those who use the channel want it maintained and open 100% of the time. This requires much dredging with all dredged material being placed in nearby marsh areas.

12. Discussion and Questions

Dr. Pritchard: The 40 foot project had some water barging - there were trade offs - the deeper channel benefitted industry but presented salt water intrusion problems.

Dr. Krone: What is the sand, silt, clay composition of the material being dredged?

Answer: Mostly silt and sand not clay although clay is sometimes found in new work dredging.

Mr. Schuldt: Who pays for beneficial uses of the material?

Answer: The cost for deepening to 45 feet is a federal cost. The cost will be shared 50% federal and 50% state for the 5 feet to go to the 50 foot depth.

Mr. Vann: The laws and regulations state that if the cost is increased because of beneficial uses of the

material it must be cost shared.

13. Fred Schilling, LMN, discussed the challenges of providing a reliable and deepened channel for navigation channel users. The current channel to Baton Rouge is maintained at 45 feet and from mile 4 AHP (Above Head of Passes) the downstream 26 miles of the river is shallow and requires deepening. The remainder of the channel through Southwest Pass can be considered as three sections each with different requirements and dredging techniques. The section from mile 4 AHP to mile 1 BHP (Below Head of Passes) is dredged by hopper dredges with the material, about 7-10 million cubic yards (mcy) annually, placed in South Pass and Pass a Loutre. Safety is an issue in this area, cutterhead dredges are not used because it is difficult for ships to navigate around them. Their (cutterhead) presence in the channel increases the collision potential. Tides and currents in this area can be problematic to ship traffic and dredges. The section from mile 1 BHP to mile 18.8 BHP is dredged by cutterhead dredges with the material placed behind levees into wetlands. Annually about 5-7 mcy of material is beneficially used. The section from mile 18.8 BHP to mile 20 BHP is dredged by hopper dredges because of the dredge maneuverability and its ability to safely move out of the way of river traffic. About 7 mcy of fine sands and silt (50-50%) are dredged annually and placed in a gulf disposal site. Dredging continues to mile 22 BHP, about 2 miles below the jetty.

14. Although South Pass is a shorter route to the Gulf, Southwest Pass is maintained for traffic because it is actually a shorter route to deep water. South Pass is also more difficult to navigate because of many bends and turns. Since the 1970's most ships use Southwest Pass.

15. Alternate types of dredges are being investigated for use in the Head of Passes area (mile 4 AHP to mile 1 BHP). A dustpan dredge, which has high production rates (almost 3 times more than hoppers) and is maneuverable could be highly successful if the discharge pipe could be modified or replaced with a long flexible discharge line. Another possibility is a pin-point or submerged dredge which has been used in Europe.

16. Federal and state pilots (from three state groups) share piloting responsibilities. The Bar Pilots are responsible from the Gulf to Pilot Town, the Crescent Pilots then take over and proceed to New Orleans and the final leg of the trip is handled by the New Orleans to Baton Rouge Pilots. They receive same day survey information and, since the channel bottom is soft and advanced maintenance techniques are used, are willing to take 46 and 47 foot draft ships through the 45 foot channel. They would like the anchorage to be deepened to 45 feet to have a safe anchorage in situations like heavy fog. However, such a deepening may adversely effect the navigation channel.

17. About 23 mcy is dredged annually from Southwest Pass although it varies from 35 mcy in 1990 to only 11 mcy in 1992. Even if all the dredged material were beneficially used to nourish marshlands it would be only a small part of the solution, there would still be significant marsh loss. The sediment load in the river has decreased drastically from the 1940's to about half the amount by the 1980's.

18. Discussion and Questions

Dr. Palermo: Is agitation dredging performed?

Answer: Not in the Head of Passes.

Mr. Vann: How are hopper jobs paid?

Answer: Hopper contracts are rental contracts.

Dr. Pritchard: What time of the year does the river rise?

Answer: Generally spring, the February to June period.

Mr. Powell: Do single hull tankers have to keep more water under the keel? This is an issue in the Federal register for comments.

Answer: This is a big issue and will restrict draft.

Dr. Pritchard: Is it possible to establish a sediment trap at Pass A Loutre and then redredge the material?

Answer: To do that would require a cost shared operation.

Dr. Pritchard: Is the greatest deposit at the toe of the salt wedge?

Answer: No there is too much sand (fluff is not a problem here).

Mr. Merino: What is the proportion of river flow?

Answer: From the river 5% into Baptiste Collette Bayou, 5-7% into Tiger Pass, and 10% into Cubits Gap. Of the remaining flow, Southwest Pass 40%, South Pass 20%, Pass a Loutre 40%.

Mr. Vann: There is a need to coordinate with the environmental groups to determine how thick the sand layer (from dredged material disposal) should be as it is deposited in the marshes. There is an appreciation here (in the District) for navigation and the environment. This is important, however, don't lose sight of navigation as primary.

19. Al Naomi continued the Mississippi River Project presentations with a synopsis of Phase III. This involves the deepening of the entire channel from the Gulf to Baton Rouge to 55 feet. In this phase the state of Louisiana is a cost sharing partner. Benefits and costs, i.e. dollars, environment, impact on fresh water sources, etc. are being evaluated.

20. Hasan Pourtaheri, LMN, discussed plans for numerical model studies of the 12 crossings between Baton Rouge and the Gulf. The river will be modeled with a 1D hydrodynamic and sediment model while a 3D hydrodynamic and sediment model will be used at the crossings. The models will be used to predict channel maintenance as the result of different scenarios of channel design, dike configuration and deepening. There are 5 series of plans each with sub-series for a total of 60 different plans. He described the 1975 physical model study of the 40 foot channel test at Head of Passes in the Mississippi River Passes model at WES. The model was a fixed bed, distorted (1:500 horizontal, 1:100 vertical) model using D_{35} = 2.0 mm granular polystyrene as model shoaling material. He discussed some of the configurations and results from the physical model tests.

Plan V series - channel relocation eastward at Head of Passes as it enters Southwest Pass.

Plan R series - removal of the west headland structure (between South Pass and Southwest Pass) and the same channel alignment as the Plan V series.

Plan W series - removal of the west headland structure with the existing channel alignment.

Plan T series - existing channel alignment with dike additions or extensions

Plan Z series - recurvature of the channel above Head of Passes to divert sediment towards Pass a Loutre

Sediment basin tests - different combinations of length and depth of a sediment basin above Head of Passes near Cubits Gap.

21. Some base-to-plan test results indicated maintenance dredging reductions of 93-96%. There was some discussion about the validity of this value. It was acknowledged that the configuration probably would reduce dredging requirements, but the model's 90 percent plus reduction should be interpreted simply as indicating only that a significant reduction would be achieved. The fixed bed physical model could not scale sediment size and extreme changes must be interpreted carefully. Numerical modeling now offers some advantages over the previous physical modeling techniques..

22. Discussion and Questions

Mr. Merino: South Pass wants to maintain itself naturally at about 17 feet. In the early 1990's it shoaled to 10 feet and attempts are being made to maintain it at 20 feet, primarily for oil and gas supply boats.

Dr. Palermo: Is there a potential to promote South Pass shoaling by putting more flow into Southwest Pass?

Answer: A model study of a 50% flow restriction of South Pass only gave 1% more flow to Southwest Pass but also more sediment. It would not be cost effective to execute such a plan.

Mr. Powell: The Mouth of the Columbia River model was a moveable bed model and performed very well.

Mr. Schuldt: Grays Harbor model, 20 years ago, predicted a 6 foot deepening would be beneficial and these results were proven correct by prototype data taken after construction.

Mr. McAnally: Any change of 30% or greater in model results must be treated as qualitative.

Mr. Combe: Pilots using the WES simulator didn't like the plan - it was not much different from base conditions.

23. Les Waquespack, LMN, spoke on the Mississippi River Ship Channel Improvements study, the purpose of which is to determine the feasibility of means to significantly reduce the O&M costs of the navigation channel. The Corps was given the authority to construct, operate and maintain the navigation channel and because of shrinking O&M funds, must find ways to lower these costs. The reconnaissance study, which is 100% federal cost, has not yet been funded but efforts are underway to identify problems to be addressed. Alternative plans to improve navigation include: a gated navigation pass; MRGO locks; Breton Sound Ship Channel locks; South Pass - open channel; risk based analyses to optimize maintenance projects and prioritize the funding of projects; accelerated repair of Southwest Pass dikes (about 150 pile dike structures, many in various stages of deterioration or damaged by ship traffic); and an alternate channel alignment for a gated navigation pass.

24. The O&M activities are budgeted for an "average" year. However an increase in dredging requirements results in less funds available for dike repair. Many structures are not large enough to be considered a major rehabilitation and a backlog of repairs now exist.

25. It was explained that Southwest Pass is longer than South Pass but South Pass is far from the 40 foot contour in the Gulf. The two mile jetty (at Southwest Pass) has settled significantly and one can expect the same settling with a new jetty at South Pass if one were constructed. This option would be too

costly.

26. Discussion and Questions

Dr. Palermo: Do you need to control the water level as locks do?

Answer: No it would be a gated structure for sediment elimination.

Mr. Merino: Can we see the pictures of the jetties again? There are sediment patterns indicating much leakage of sediment laden water through the jetties.

Dr. Pritchard: The questions you are presenting to the CTH deal with channel maintenance. What about environmental questions?

Answer: Any action taken must always be mindful of the environmental and other impacts.

Dr. Pritchard: Any 55 foot channel model test performed will have to test the 1988 drought conditions with an underwater salinity weir constructed to 45 feet.

27. During the presentations several guests from state agencies joined the proceedings. For their benefit, Mr. McAnally summarized the technical role of the CTH and stressed that the CTH does not set policy, its function is to supply technical advice. The Committee has no enforcement authority.

Atchafalaya Basin

28. Troy Constance, LMN, reviewed the history of some existing projects in the Atchafalaya basin. Levees were constructed in 1915 to protect land from flooding and to keep sediment out of these protected areas. A later basin study suggested using segments of levees to allow some flooding and sediment distribution. In 1936 a controlled spillway was constructed to collect all runoff, additional protection levees were built and in 1941 the Wax Lake outlet was completed. By 1946 the levee was extended to the east past Morgan City with the inclusion of breakwater protection. The area is now completely enclosed and the locals operate pumps to control flows. The Corps participates by performing major pump repairs. Over time there were several attempts to control runoff and flow. Wax Lake was completed in 1941 and the levees extended until today, almost all of the basin area is enclosed. During the period from 1960 to 1975 the north end of the basin silted in resulting in the formation of a delta. The Wax Lake weir was constructed in 1987 to constrict flow in order to scour the lower river, first at an 80/20 and later at a 70/30 split. The weir was removed in 1994. The present uncontrolled river flow is difficult to maintain for the navigation project.

29. The Flood Control Study, a reevaluation of the present project, is in the feasibility stage. To model the backwater areas, which are growing, models such as: UNET - unsteady state; HEC-6; CH3D-WES; HEC-2 - flow lines; TABS with salinity and direction of flow; and the LSU Mary White habitat prediction model will be considered for use. For Houma, LA hurricane protection, HEC-1; HEC-2; UNET; and habitat models may be employed.

30. Questions presented to the CTH regarding the Atchafalaya basin were:

a. An option being considered is to build a 12 mile levee at Point Chevreuil. Is the TABS model the correct one for evaluating the effects of this structure?

b. A "sediment ramp" - a ramp from the -40 foot river bottom up to -8 foot shallow lake - is being tested to determine if sediment from the deep water will move up the ramp and out of the system. To date no data have been collected to prove ramp effectiveness. Is there a model that will evaluate the effectiveness of such a sediment ramp?

c. The ramp is cut through clay, and the high water velocity is 8 ft/sec. If the sediment is moved (via the ramp) into Wax Lake the problem will be to get the sediment past the GIWW. Can you suggest a sampling program to evaluate the sediment ramp?

31. Discussion and Questions

Mr. Merino: Is there a phase difference between the east and west ends of the study area?

Answer: Yes, diurnal tide and semidiurnal tide

Dr. Pritchard: What is the depth of the water in the marshes? This question came up in the 1988 CTH and I believe a model radio controlled boat was used.

LSU Guest: Marsh porosity is important - how long water stays in a marsh.

Mr. McAnally: What do you expect to come out of the study?

Answer: Modification of distribution of flow for navigation projects. There are many conflicting views and factors, some plans may be acceptable to some but not others.

Mr. Powell: You can't have two unregulated outlets, one will capture the flow. You need to develop sediment tools to look at the problems. TABS is a good delta predicting model.

Mr. Constance: Any plans for flow distribution must be considered in light of the Old River Control Structure. Care must be taken because of the head differential problems and the integrity of the structure.

Mr. Merino: How much subsidence occurs?

Answer: It varies from 1.5 cm/yr in the delta to about 0.5 cm/yr further north.

Barrier Island Study

32. Jim St. Germain, LMN, briefly discussed aspects of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). This is a multi-agency group chaired by the Army and assigned to the New Orleans District Engineer. It is funded at $40M per year from 1991 - 1997, must be completed by 2005 and its intent is to have no net loss to coastal wetlands due to developmental activities. The area is divided into 9 hydrologic basins. At Bayou LaBranche 2.5 mcy of material were used to restore wetlands at a cost of $3.7M. There are 350 acres of perimeter, 250 acres marsh and the rest is open water. Bank stabilization was performed at Freshwater Bayou, and the Vermillion River cutoff has just been completed. Things to consider are: major river stages, navigation, barrier Islands, and shoreline erosion.

33. Discussion Questions

Mr. Powell: What is the rate of savings over loss?

Answer: Savings: 75,000 acres at $200M; Loss: 16,000 acres/year

Dr. Krone: Do you calculate sediment load?

Answer: Yes

Mr. Powell: What are you using for sea level rise?

Answer: Subsidence rates vary with each site. In the delta it's about 5 ft/100 yr.

Mr. Vann: Is the rate of subsidence increased with marsh building?

Answer: There is some subsidence but there is a net gain. The area is overfilled so after a few years of compaction it is at marsh elevation.

Mr. Powell: Is there a value system to put a price on an acre of wetlands?

Answer: We use a "habitat unit" to evaluate each study, the % of vegetative wetlands, % shallow open water, salinity, and water depth. We will consider the future with and without the project over the 20 year project life and come up with average annual acres and average annual habitat.

Mr. Vann: You might consider conducting an analysis of areas that will be of value due to subsidence such as uplands going to marsh, and let nature work for you.

Dr. Palermo: This is not done under a broad Corps authority such as navigation, flood control, or environmental restoration, but is specific for coastal Louisiana.

Answer: There are provisions in the act that provides funding of 75% for LA and 25% for others states. This competes with other CW projects for funds. The maintenance costs are included in the 20 year program life. Planning costs are about $5M annually and are not cost shared. Construction costs are shared and depends on the program authority. On federal environmental restoration projects the share

is 75% federal and 25% state.

Mr. McAnally: There is the least cost rule for Corps O&M projects. Is CWPPRA paying the increased cost of dredge disposal, which is constrained by O&M?

Mr. Vann: It takes a given number of cubic yards to build a marsh. Have you looked at the cost of dredging with beneficial use versus the cost of buying mined material as cheeper?

Answer: We have looked at it with the hopper dredging of Southwest Pass and found the opportunity costs were not there.

Dr. Pritchard: Have you considered the cost of using rehandled material from a sediment trap?

Answer: Wetlands need silts, not the sands of dredging.

34. Steve Smith of T. Baker Smith is the lead contractor of the Barrier Shoreline Feasibility Study. This is a part of CWPPRA and concerns habitat, recreation, infrastructure and shoreline retreat. It is a $2.5M - three year effort consisting of:

Mississippi and Atchafalaya - Phase 1
West Louisiana - Chenier plane - Phase 2
East Louisiana - Chandeleur and Breton Sound - Phase 3

The Technical Review Committee is a team of economic, environmental, modeling (wave, hydrologic, environmental) and engineering talents.

35. Joseph Suhayda, LSU, discussed the modeling efforts to quantify the impacts of barrier islands in terms of hydraulics, particularly hydrology. Barrier islands are modeled as an open system, very flat (0.9 feet NGVD) with large expanses of vegetation as the roughness elements. As the water level changes, the marsh acts as a low pass filter. He used an existing model which is vertically averaged, employees a finite difference approach, and allows nesting of grids. The Mannings coefficient is a function of water depth. The model, which can not resolve small scale features, has a 1D model nested in it. It handles wet/dry cycles and geometric properties. Using a 10,000 foot grid, the model proved qualitatively the concept that barrier islands work. He wants to study the effect of barrier islands on tide and hurricane surge in order to evaluate the effects on plants on the depth and duration of flooding. It is very difficult to establish the mean water level.

36. Discussion and Questions

Mr. Merino: Have you input salt and mud into the model?

Answer: Not yet we want to get a handle on the hydraulics -- depth and duration first.

Dr. Pritchard: There are differences that could be significant for this study between NGVD and the North American Vertical datum. Also have you considered a boundary fitted model?

Answer: The computational load for the boundary fitted model is too great. Another model, the NWS "slosh" model is not available to the public.

Mr. Vann: There should be tidal gage data available along with temperature and some long term tidal phase information.

37. Paul Kemp, LSU continued with the study attempts to translate the hydrologic effects on habitat. They are trying to separate the processes that effects the project areas and are using the "ST wave" model. They are attempting to model salt and brackish marches (but not floating freshwater areas) to predict habitat change. The habitat model is a simplified version of Joe Suhayda's hydrologic model. It has three time scales: hourly, daily, and annual. To verify it, they are using sediment erosion tables and are trying to track subsidence, accretion rates and elevations to match historical maps of habitat and land loss distribution.

38. Discussion and Questions

Mr. Merino: Do you have mass balance in your erosion model?

Answer: Eventually but not there yet.

Dr. Pritchard: Do you have swells in the area?

Answer: It is surprising at the amount of wave energy in the area.

Dr. Palermo: Substrate accumulation model contains water, sediment, salt, sun, wind, rain, evaporation - it seems extremely complex. Has this or other models like this been used before?

Answer: This district has used it before.

Mr. Merino: Sometimes there are problems connecting models. What is the boundary transport mechanism?

Answer: We use a finite difference movement across cells.

Dr. Krone: How much detail for episodic events?

Answer: It is in the model on an hourly time scale.

Dr. Palermo: Sounds like you are still in the calibration mode.

Sediment Diversion Study

39. Tim Axtman, LMN, outlined some provisions of the Mississippi River Sediment, Nutrient and Freshwater Redistribution Study which is a task under the Coastal, Wetlands, Planning, Protection and Restoration Act. The purpose of the study is to restore components of wetland growth. The study involves identifying, designing, evaluating and recommending a feasible means of supplying freshwater, nutrients and sediments to wetland areas using different schemes of freshwater and sediment

diversion. One aspect of the study is to review previous planning efforts and select the most promising for further study. To date about 70 projects have been identified for consideration. The study is in year 1 of its 3.5 year time frame.

40. Discussion and Questions

Dr. Palermo: Are you looking at the interaction these 70 projects might have on each other? There can be synergy - two projects may be better than each alone or the opposite, an action in one sub-basin can be detrimental to another.

Mr. Merino: The study output should be as detailed as funds permit to allow other studies to go on. You will probably have to go to a GDM.

DNR Guest: How much resources (water and sediment) do we have to meet navigation, fresh water, and marsh restoration needs. We should try to reproduce nature and use available excess water such as high spring flows for these diversions.

41. Kevin Fagot, LMN, discussed Mississippi River modeling efforts for the freshwater diversion study. The model extends 330 miles from the Old River Control Structure through Southwest Pass to the Gulf of Mexico. The aim is to study the effects of freshwater diversions on navigation and water surface elevation in the river. He is using the HEC-6 moveable boundary model with the ability to reintroduce dredged material into the system. The Base model has 9 outflow points and the planned tests will have up to 19 local inflow and outflow points. The model contains the geometry, suspended sediment, bed material gradation, flow and temperature from data obtained from the 1983-1985 Mississippi River hydrographic survey. It was verified using a 300,000 cfs low flow, 700,000 cfs medium flow and a 1,100,000 cfs high flow condition. The model data of water level elevations were within the band of observed prototype date and the suspended sediment trends of model to prototype comparisons were good. When using 7 years (1985-1991) of dredging data, the following results were obtained:

	Model	**Observed**
MS River Crossings	64 million cy	69 million cy
SW PASS	114 million cy	116 million cy

After each adjustment was completed the model was checked to be sure previous unadjusted conditions remained unchanged. Adjustments were made only to input parameters not hydraulic conditions. The model was run simulating the 16 year period 1978 - 1993 which included two Bonnet Carré operations (1979 and 1983).

42. Discussion and Questions

Dr. Pritchard: What is the suspended load of fines in the Mississippi River? Have any studies addressed this?

Answer: In the Mississippi River fine sands are 25% of the suspended load. This is about 200 million tons/yr and the concentrations are about 300 ppm.

43. Charlie Berger, WESHL, concluded the technical sessions with an update on the Bonnet Carré Freshwater Diversion modeling effort. This work is an outgrowth of the last CTH meeting in which the Bonnet Carré Freshwater Diversion project was presented. The 3-dimensional model has been validated to existing conditions and various scenarios of Bonnet Carré

diversion flows have been run. The model uses a boundary salinity of 35 ppt and tides constructed from prototype data. Each boundary node has tide phase and range which varies with location within the grid. The model shows that when it floods at the Gulf entrance to the MRGO, it is still ebbing in the MRGO by the second outlet and there is noticeable salt influx into Lake Borgne. The modeling effort has progressed with the completion of base and some plan experiments and the beginning of the report. The current experiment has all passes connecting Lake Borgne to the MRGO closed.

44. Discussion Questions

Dr. Pritchard: Events that cause the lake and MS Sound levels to change (fetch, meteorological frontal passage etc) may be important on the prototype but may not be significant on monthly mean salinity.

Mr. Merino: How stable was the model?

Answer: There were places that misbehaved especially with high salinity gradients. We considered cutting the time step and this would work, however, it would be a considerable effort to change the boundary file. We use 1 hour time steps.

45. Two field trips were planned in association with the Bonnet Carré Freshwater Diversion Study which was presented to the CTH at the 104th meeting. Midway through the this year's Technical Sessions a trip to the IHNC lock was taken by the Committee members. The lock operation, location, and use were part of the Committee deliberations in formulating answers to the Bonnet Carré questions. A second field trip to the Bonnet Carré Spillway was planned at the conclusion of the Technical Sessions. The Committee agreed to cancel this outing because of poor weather conditions and the concern that the committee had much to do and could use the extra afternoon to its advantage. The Technical Sessions ended the Committee began the Executive Session.

Executive Session

46. Mr. McAnally called the executive session to order.

47. **Minutes of the 104th meeting.** No changes or corrections were offered and the minutes of the 104th CTH meeting were accepted.

48. **Fiscal Report.** Mr. McAnally distributed copies of the final 1995 fiscal report. According to CEFMS, the CTH achieved 100% execution. He also distributed copies of the tentative budget of $17,500 for fiscal 1996. Some funds ($2,500) were left at HQ for travel. Mr Powell indicated as soon as his travel expenses were paid all remaining CTH funds will be returned.

49. Mr. McAnally said that the cost of one CTH meeting averaged between $12,000 and $15,000. In the past the minutes have been extensively edited with over 350 copies prepared and distributed, all at high cost. Given the current budget, there will be very little available for the editing, preparation and distribution of this year's minutes. He invited suggestions for cost cutting measures. After some discussion, suggestions included:

a. Prepare a minimum number of copies to be distributed to the Committee members and the Corps sponsoring District.

b. Make an electronic file of the minutes available and e-mail the 350 usual recipients where the file can be retrieved and let each one print his own copy.

c. Post the minutes (or Executive Summary) on one of the Corps World Wide Web homepages or a bulletin board system.

50. The financial statement and budget were approved along with the recommendation to find alternative means of distribution of the minutes. If a cost savings can be realized in this area perhaps there will be funds available to publish some reports.

51. **Membership list.** The membership list was reviewed and corrections made.

52. **Discussion of the New Orleans Projects.** To facilitate the Committee's ability to answer the questions presented by the New Orleans District, four sub-committees were established. They were:

Mississippi River Ship Channel: Dr. Palermo, Chair, members Mr. Combe, Dr. Pritchard, Mr. Vann and Ms. Pankow. Messrs Letter, McAnally and Combe will serve as resource persons.

Mississippi River Diversion: Mr. Marino, Chair, members Mr. Combe, Dr. Krone, Dr. Pritchard, and Mr. Schuldt.

Shore and Barrier Island Feasibility Study: Dr. Krone, Chair, members Messrs Butler, Combe, Merino, Schuldt, and Vann. Messrs Butler, McAnally and Combe will serve as resource persons.

Lower Atchafalaya River: Mr. Blake, Chair, members Mr. Butler, Mr. Combe, Ms. Pankow, and Mr. McAnally.

53. Mississippi River Ship Channel The questions presented to the Committee were:

a. With regard to the modeling being performed for Phase III at Southwest Pass:

(1) What other alternatives should we model?

(2) Is the sediment trap located and sized correctly?

(3) For the alternatives being modeled, will they work both in the short and long term?

b. For the Reconnaissance Study, are there other alternatives to study?

c. In maintaining the existing channel, will performing more advanced maintenance be effective in maintaining the channel?

d. Any recommendations regarding closing Cubits Gap or Pass a Loutre to assist maintenance?

e. Recognizing that the river serves not only navigation but also flood control, is there anything else that might have merit that should be explored?

To this the Committee added for consideration:

f. How are we going to handle salinity in drought years in a 55 foot channel?

g. Are there alternative dredging methods that can be used to maintain the reach at Head of Passes?

54. The discussion on the ship channel study included remarks about the possibility of locating a sediment trap on each side of the channel, the advantages, if any, of co-locating the sediment trap with the anchorage, and the feasibility of relocating the sediment trap to a more advantageous location. Some traditional practices, such as repairing the levees to prevent leakage, might also reduce maintenance dredging requirements. Also discussed was the possibility that sediment may be maintaining the marshes via Pass a Loutre. When the question of closing Pass a Loutre was raised the members were informed that a 1937 model study indicated that the pass had to be closed 90% at the mouth to effect any change. The system is friction controlled not nozzle controlled. There is an ample amount of survey data available for this region of the river and it should be examined to estimate sedimentation rates. This would be helpful in evaluating the benefits of advanced maintenance.

55. Further discussion centered around not only reducing dredging but beneficially placing or diverting the sediment into South Pass and Pass a Loutre where it may contribute to marsh growth. The optimization of training structures was considered and numerical models would be an ideal tool to use. In any planning and decision process it was agreed that the river pilots must be considered in the plans.

56. Shore and Barrier Island Feasibility Study. The questions presented to the Committee were:

a. What effects will restoring the barrier islands and narrowing inlet sizes in the Barataria and Terrebonne Basins have on tidal prism and what are the resulting effects on mainland wetlands?

b. What is the feasibility of narrowing inlet sizes in the Barataria/Terrebonne estuary to reduce the tidal range by one half of the current range?

c. What is the probability of the restored barrier islands remaining effective at protecting mainland wetlands over a 20 to 50 year period?

d. Are barrier islands effective at protecting wetlands?

e. Is this numerical approach going to give a good approximation of barrier island impacts on water depths over the marshes?

57. The discussion included remarks and comments that the inlets are not in equilibrium - they are too big, there appears to be insufficient sand in the system. The district may be trying to use a barrier island to solve a subsidence problem. There needs to be more sand in the system and perhaps the best method to do this is to use diversion, this appears to be working in the Atchafalaya Basin. Barrier islands will attenuate the tide range but not a storm surge. To maintain a status quo or improved barrier island condition would require continual maintenance, similar to beaches, and would probably be a significant cost. The system must be treated as a whole, there appears to be no master plan to relate all the smaller parts and sub-systems. There has been measurable retreat of the barrier islands, the District needs to get data and techniques from other completed barrier island restoration projects and build on that success. Perhaps Grand Island has something to offer. Perhaps material from Ship Shoal can be used in this project.

58. Mississippi River (Sediment) Diversion Four statements and related questions were presented:

a. The 1990 Mississippi River Delta Study reconnaissance report projected that with a 300'X10' pilot channel, a 70% capture of total river flow would occur over 5 years. This follows most historical data regarding cutoff channel captures. Is there a feasible technical basis to believe that this capture could be effected over a period of months rather than years potentially reducing the additional shoaling impacts to the original channel?

b. Several existing diversions and several more authorized diversions have been designed with salinity control as a principal criteria. A secondary benefit of these diversions is the distribution of fine suspended sediments to the wetlands. What is the potential for land building in wetlands and shallow open water areas with fine material exclusively? Is there any precedent for this type of land building elsewhere?

c. A secondary objective for the diversion of sediment is the supplementation of the coastal sediment stream. What, if any, export of diverted coarse grain material, through wetland areas to the coastal stream could be expected without direct channelization? What estuarine conditions might be conducive to this type of sediment export.

d. An interest has been expressed in re-establishing river flow in previously abandon or cut-off distributaries in order to expand the spatial extent of riverine influences in the coastal wetlands. If small to moderate redistributions of flow are re-established in these channels is there any technical basis for predicting whether they would or would not be hydraulically stable?

59. Items covered in the discussion included the information that at Old River the flow split was 70/30. When the flow is greater that 2 million cfs it goes to 50/50. If the purpose is to divert water and sediment out of the Mississippi River while maintaining the navigation channel with reduced dredging, where would you make the cut? A structure would probably be needed and any plan must consider the river head. Delta growth would start at the diversion and build out. If the diversion was far down Southwest Pass this plan would not reduce dredging requirements. A slack water channel, something like the MRGO, with locks might result in lower dredging requirements. Then the sediment in Southwest Pass could be used for marsh nourishment. The standard theory on delta building is that the clays are first to build a base or platform upon which sands build to create ridges and the soft sediments fill in and build until the marsh is above water. For marsh creation the fines will not settle without quiet water and may take a long time to occur. This could be facilitated with diking but it would be very expensive. Sediment in existing marsh areas with vegetation will settle under its own weight and needs renourishment to maintain the above water marsh elevation. A fresh water diversion in Davis Pond was used to maintain marsh freshness for oyster production. Fresh water diversion will help plants survive and they in turn will help build the marsh. Sand sediment from mile 116 above Head of Passes is the size beneficial for delta growth and marsh creation, however, if one wants to get it to the coastal sediment stream it would have to be mined and transported to the desired location. The belief was that there was a chance that this could work but concern was voiced that the gas and oil pumping may be reasons for subsidence which might counteract sediment buildup. The statement was made that flow could be re-established in abandoned distributaries but there would be a price to pay by those who live in the area.

60. Lower Atchafalaya River. The questions presented to the Committee were:

a. Is the TABS 2 model a suitable choice for evaluating the effects of the Point Cheveuil jetty on movement of sediment and water to the west?

b. Is it possible to direct more bedload down the shallow Grand/Six Mile Lake part of the Wax Lake Channel by artificially creating a transitional "ramp" between the deeper main channel and shallower Wax Lake side?

c. Would this move (creating a ramp) generally be a possible means for manipulating coarse sediment distribution in deltas like the Lower Atchafalaya delta?

d. Can you measure sediment going up the ramp? How can we quickly determine how effectively a ramp is moving bedload material?

e. Does the Committee have any other comments or observations on the Atchafalaya River Delta Evaluation Restudy proposal?

f. Material from maintenance dredging of the bar and Morgan City entrance channels is disposed in open water about 15 feet deep and about 2,000 feet to the east of the channel. Since the predominant drift direction is East to West is it possible that the same material is being continually redeposited and redredged from the channel?

61. The discussion of question 60.a. included remarks that the proposed jetty would be 12 miles long, difficult to make impermeable, and would definitely interfere with navigation. The District should carefully examine the feasibility of such a project. The TABS model was used in 1985-86 to predict the shape and deposition of sediment in Atchafalaya Bay. It was not designed to follow a sediment plume. However, it is a tool of choice but must be verified to model and study coastal currents. In discussing the pros and cons of the jetty proposal, the list of cons included: a) it would be a general navigation hazard, b) a small boat safety hazard, c) extremely high cost to construct and maintain, d) the jetty might alter the circulation of the area, water would pile up and move around the end of the jetty, e) it would require millions of tons of rock, f) there would be settlement which would require additional material to maintain jetty height.

62. Discussion of questions 60.b and 60.c indicated that the configuration of the subject area needs to be examined to understand the geometry. There are means to theoretically compute the slope needed to move sediment up a ramp but there was skepticism as to the success of such an attempt. Material can be diverted by dredging the channel to the thalweg depth. The model CH3D-WES could be used.

63. Comments on question 60.d included getting a bottom current profile and some measurements of the sediment concentration. A bedload sediment sampler, an optical backscatter device or a hot film probe could be used. However, such instruments might not work in very high concentrations of fine sands. The use of a fluorescent dye to tag and track sediment movement would indicate the amount entering a side channel or sediment ramp.

64. Regarding question 60.f, it was felt that current meters and directional wave meters could be used to establish the energy climate. The material is silty sand and dredging occurs about every two years. If the material is sand, it probably moves only during storm events, therefore try to take measurements during these storms.

65. Mr. Merino commented that natural diversions put a lot of water but not a corresponding amount of sediment into the system. He remarked that the Red River has much sediment but a lot of (delta) growth does not come out of the Mississippi. Nancy Powell, who was invited to the Executive Session to address Atchafalaya questions, indicated the Red River has sediment concentrations of 500 to 1000 ppm, more silt and clay with some very fine sands. In 1972, for the first time, sands showed up in the Atchafalaya Bay. With 150 cfs fresh water coming out of the Atchafalaya, fresh water vegetation populates the delta lobe.

66. The discussion of questions ended, Mr. McAnally requested the chairs of each sub-committee to notify him by 15 April of the estimated date a draft report will be available. Dr. Pritchard suggested it may be desirable to combine some responses because there was overlap in some questions. Concern was also expressed that the District might feel that the restoration of barrier islands will support marsh building. The real coupling is sediment diversion to establish and build marshes. There appears to be a big disconnect. Perhaps the District should be encouraged to invite an outside committee to evaluate the proposals. In addition, the CTH may want to recommend that a literature search be conducted. Dr. Pritchard requested that each member receive a corrected agenda to correspond to the order of the actual presentations. It will make it easier to follow ones notes.

67. **CTH Survey and Recommendations for CTH Activities.** Mr. McAnally distributed a summary of the CTH survey responses and a list of recommendations extracted from them. Each of the recommendations was reviewed and discussed.

a. Publicity - It was agreed that the CTH should be promoted. Henry Simmons had started a brochure which Mr. McAnally is unable to locate. He will check with the former Chairman, Mr. Herrmann to see if he knows of its whereabouts. The CTH should be publicized, with something like a 15 minute presentation, at Coastal and Hydraulic

workshops and other target of opportunity meetings. Information can also be posted on an Internet, perhaps as part of the HL home page.

b. Research needs statements - The CTH should try to position itself to take advantage of cost sharing activities. Dr. Krone will take a cut at a proposal to address reducing sedimentation (dredging requirements) in estuarine channels. He felt that another suggestion, to do a new evaluation of underkeel clearance, did not belong with the CTH. Mr. Vann was willing to prepare a few words on the topic of techniques for rapid integrated environmental (hydrodynamic to sediment to water quality to fisheries) evaluation of estuarine navigation and flood control projects and would modify it to include the disposal aspects.

c. Update the 1963 report, "Evaluation of Present State of Knowledge Affecting Tidal hydraulics" - A copy will be sent to the members to review and a determination will be made if there is the resolve and energy to undertake this task. Mr. Powell suggested that extracts of this report be included in the brochure.

d. New members and consultants should be considered that will provide needed expertise and continuity as members retire. Another suggestion was to develop a "pool" of experts in different areas and invite the specific expertise needed to participate in the meeting. Mr. Merino suggested establishing a list of potential consultants who would not be full time CTH consultants, but would be issued special invitations to fill a specific expertise niche needed for a CTH assistance request.

e. Adopt a 4 day meeting structure - No consensus was reached, the feeling was that this should be decided on a case by case basis. Depending on the location, three and a half days of sessions with a half day travel at either end may be a good solution.

f. Additional working session for the subcommittees. Such a session to finalize the subcommittee report could be done on an as needed basis.

68. **Plans for the next meeting.** Mr Vann indicated a James River topic might be appropriate with the meeting in Norfolk, VA. Mr. Powell suggested it might also be a good idea to have some follow up on this New Orleans meeting. Mr. Merino recommended that the questions have structure and be focused. Also that handouts of all presentations would be useful.

69. Mr. McAnally informed the Committee that he will be on long-term training beginning in August, 1996. He intends to attend the next CTH meeting but questioned if someone else should be the Chair. The Committee felt this was unnecessary, Mr. McAnally should remain Chairman and could call on any of the Committee members for assistance with CTH responsibilities.

70. **Election of Officers.** Mr. Powell conducted the proceedings for the election of CTH officers. Mr. Blake nominated Mr. McAnally for Chairman and Ms. Pankow for Executive Secretary. Mr. Merino seconded the nominations and with a unanimous voice vote Mr. Powell declared the officers reelected.

71. Consultant and Member Comments.

a. Dr. Krone remarked that the price of failure is very high. Restoration projects have a way of failing. Clear study objectives are very important. One should know what nature does and fit the project into the natural process. There appears to be very little appreciation for the need of plant systems to retain the soil. The character of the soil is important if you want to have more than a big sand pile. As always, he has enjoyed the meeting and felt he has learned a lot, the problems presented were very different and interesting.

b. Dr. Pritchard remarked that the WES model of Lake Pontchartrain with the IHNC and other features indicated that Bonnet Carré decreases the salinity over the target area. Questions remain of the relative impact of Seabrook and the other two large passes to Lake Pontchartrain and their contribution. There are still those who want to close IHNC. A technical team is needed to look at putting a lock at Seabrook, they need to show the results of that plus the results of closing MRGO from Lake Borgne. Concerning the tests Charlie Berger is conducting a verification run with existing conditions and no diversion should be run. If the salinity match is good for the target area, a run with Bonnet Carré diversion, according to the formula, should then be run. Additional runs without diversion should be done which look at the effects of closing each of the entrances. Using present conditions, run each of the following conditions: 1) passes closed, Seabrook open; 2) passes closed, Seabrook closed; 3) passed open, Seabrook open. For the Gulf boundary consider running sub-tidal sea level variations. Keep the tidal constituents the same but add the non-tidal components.

c. Mr. Merino echoed Dr. Krone's comments and expressed real concern about trying to divert the river channel.

d. Mr. Schuldt also agreed with Dr. Krone and added that it takes a long time to fully evaluate the success or failure of environmental restoration projects.

e. Ms. Pankow indicated she has learned new things from the sessions, but expressed concern that the presentations on policy and planning, although interesting, where not issues the CTH should address. She would have liked the sessions to be more technical and focused.

f. Mr. Vann thanked Mr. Combe for his hospitality and commended the District for asking some tough questions even though he felt they may have been the wrong questions. The CTH should take the opportunity to answer these questions in a technical, polite and firm way. The District has set up a good process which holds much promise. Restoration projects tend to be big projects but he is not sure they can restore the things man has done.

g. Dr. Palermo commented that the set of problems seems to have been examined individually and not as a whole system. There are many conflicting interests, with flood control and navigation competing against restoration. It is difficult to tell where the water is going, the District needs to take a holistic approach and look at the all the parts.

h. Mr. Merino expressed his thanks to Mr. Combe for hosting the meeting. He stated that Mother Nature has been building deltas for a long time, it is a natural process, however man has conflicting interests. The District needs to assist the people in the governor's office to appreciate the facts. The consequences of these efforts needs to be evaluated before decisions are made. We can build deltas, marshes and barrier islands but it will effect, sometimes significantly, the current economy and lifestyles of those in the effected areas.

I. Mr. Powell felt that one needs to take one small step at a time. Restoration projects tend to be losing propositions. One must work cautiously and needs to coordinate all efforts. Environmental aspects are almost 50% of projects now. We need to put on our environmental hats and consider environmental recommendations.

j. Mr. Combe commented that the nature of the things discussed present very complex problems. He wanted the Project Managers to present an overview and then the technical team present the technical aspects. There are five agencies on the task force, each one having his own view point.

72. **Adjournment.** Mr. McAnally thanked Mr. Combe, the District and the Committee members. Having no other business, the 105th Meeting of the Committee on Tidal Hydraulics was officially adjourned.